Letters to the Editor

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Listeriosis in Minnesota, January 1986 through May 1988

Listeria monocytogenes is increasingly recognized as an important cause of meningitis, septicemia, spontaneous abortions, stillbirths, and neonatal mortality in the United States.[1] National data indicate that the overall incidence of sporadic listeriosis is low, but that it varies by geographic region.[2] Because the incidence in the North Central region of the United States has not been clearly established, we conducted a study to determine the baseline incidence of listeriosis in Minnesota.

In March 1987, we contacted all 170 hospitals in Minnesota and asked them to report cases of listeriosis with onset after January 1, 1986. We initiated active surveillance (monthly telephone calls) at the 13 tertiary-care hospitals in the Twin Cities metropolitan area, where approximately half of Minnesota's 4.2 million people live, and passive surveillance (with

validation) at the hospitals outside the Twin Cities. We also reviewed death certificates that listed listeriosis as a cause of death. A perinatal case was defined as a pregnant woman or neonate from whom *L. monocytogenes* was isolated from a sterile body site; the maternal–infant pair was counted as one case. A nonperinatal case was defined as someone other than a pregnant woman or neonate from whom *L. monocytogenes* was isolated from a sterile body site. We calculated the overall annual incidence using the general population of Minnesota residents; we calculated the perinatal rate using the number of live births.

Fifty-five cases of listeriosis were identified with onset of illness from January 1, 1986, through May 31, 1988. Twenty-six of these cases were identified retrospectively, and 29 were identified prospectively. Listeriosis was listed as a cause of death on four death certificates.

Illness onsets were distributed evenly throughout the study period with no seasonal trends (Figure 1). The mean age of case patients was 56 years (range, birth

to 89 years); 30 (55%) of the case patients were male. Seven cases (13%) were perinatal; 47 (85%) were nonperinatal, of which 31 (66%) were in persons over 60 years of age. The overall annual incidence was 0.5 cases per 100 000 person-years. However, incidence varied by risk category. The perinatal incidence (4.3/100 000) was 21.5 times greater and the incidence in persons over 60 years of age (1.9/100 000) was 9.5 times greater than the incidence in persons less than 60 years of age (0.2/100 000).

Information on underlying medical conditions was available only for cases that occurred after February 1987: seven patients (21%) had cancer, seven (21%) were receiving steroid treatment, six (18%) were maternal–infant pairs, two (6%) had chronic alcoholism, and one (3%) was infected with the human immunodeficiency virus. Ten (30%) had no underlying medical condition; these patients were all over 60 years of age.

Our study showed that the incidence and characteristics of listeriosis cases in Minnesota were similar to those seen in
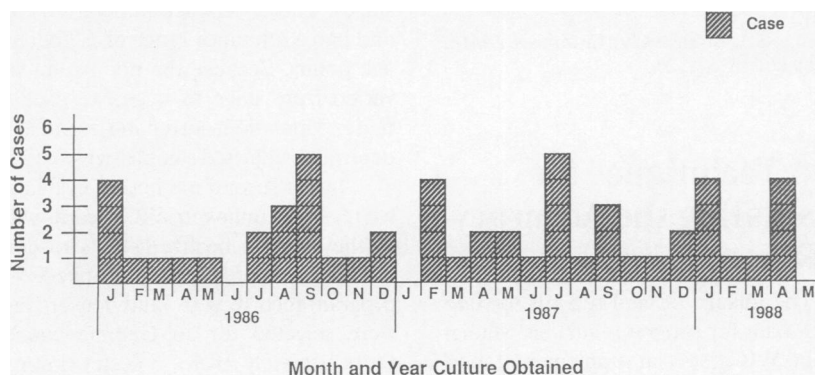

FIGURE 1—Cases of Listeria monocytogenes infection by date that culture was obtained, Minnesota, January 1, 1986, through May 31, 1988.

other parts of the United States: immuno-suppressed patients, pregnant women, and neonates were found to be at highest risk for disease. Previous investigators also noted an increased incidence in persons over 60 years of age[3]; in Minnesota, 30% of reported cases occurred in patients over age 60 with no underlying medical condition identified.

Most outbreaks in the past have been identified through clustering of cases by hospital or laboratory; therefore, an increased incidence of sporadic cases may go undetected. Surveillance data are needed to establish regional rates of listeriosis and to detect increases in disease. Investigation of detected clusters, in turn, may identify common-source outbreaks due to contaminated products. □

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Two Techniques for Evaluating the Accuracy of Record Linkages

The linkage of vital records to state health data for programs such as Medicaid and WIC ([special supplemental food program for] Women, Infants, and Children) is commonly referenced in journal articles.[1-7] However, published studies such as these rarely discuss the evaluation of the linkage. Here, we describe two

techniques used to evaluate the WIC and birth certificate record linkage in Georgia for the years 1989 and 1990.

The purpose of the first method of evaluation was to classify the matched records as properly or improperly linked. After linkage, we visually inspected five simple random samples from data linked at each linkage stage. Sample size calculations from the first three stages resulted from the assumption that 90% of the record pairs were correctly matched. For the final two stages, sample size calculations were estimated on the assumption that 80% of the pairs were correctly linked because the matching variables used in stage 4 and 5 comparisons would not have provided the same level of discrimination as the ones used in the first stages. The confidence interval was 95% and had a tolerance range of ±2 percentage points. Because the population sizes varied from stage to stage, we used the finite population correction formula[8] to determine adjusted sample sizes.

In the second method of evaluation, we reviewed unlinked WIC records with 1 of the 19 state health districts to determine why records were not linked. WIC program records with valid delivery dates were selected for 16 Georgia counties (approximately 10%). Selected information for each unlinked WIC record (n = 1270) was sent to the health district. WIC clinic personnel were asked to review their records and determine any possible reason for nonlinkage. Using this

information, we classified the reasons for nonlinkage.

The number of incorrectly matched records was ascertained from samples we selected and visually inspected. Sample sizes ranged from 646 to 1220 for 1989 and from 719 to 1215 for 1990 (see Table 1). Less than 3% of the sample from each stage of linkage contained invalid record pairs.

Many unlinked WIC records (44.1%) had a valid reason for nonlinkage and were true negatives. Valid reasons for nonlinkage included pregnancies ending in spontaneous abortion (n = 190), the known relocation of WIC mothers (n = 183), the delivery date was not in 1989 or 1990 (n = 157), and "other" (n = 29). Another 40.3% of unlinked WIC records were considered to be potential linkages. Almost 9% did not link because of a missing date of birth. The "other" category (9.2%) had errors such as misspelled names and records with missed sets of twins. Not enough information was provided to determine the linkability for almost 16% of the records. Approximately one fourth (22.4%) had no identifiable reason for nonlinkage.

We used two validation techniques to estimate the percentage of invalid and missed linkages. The first method involved selecting samples for visual inspection to identify invalid linkages after each round of linkage. The second method of evaluation required a review of one local health department's WIC records that,

TABLE 1—Evaluation Method One: The Estimation of Incorrectly Linked (False-Positive) WIC–Birth Records, by Stage of Linkage, Georgia, 1989 through 1990

Stage	Total No. Linked Records	Sample Size	False-Positives, %[a]	95% CI
1989				
1	29 165	839	0.5	.2, 1.4
2	9 197	789	0.2	.0, .9
3	737	646	1.2	.5, 2.4
4	5 947	1 220	0.9	.5, 1.6
5	3 006	1 016	0.0	.0, .3
1990				
1	29 919	840	0.2	.0, .8
2	6 858	767	0.1	.0, .7
3	742	719	0.0	.0, .5
4	6 303	1 215	2.4	1.7, 3.5
5	2 994	1 015	0.0	.0, .4

Note. Stage refers to an iteration through the data in which a different set of variables was used as the linkage criteria. WIC = (special supplemental food program for) Women, Infants, and Children; CI = confidence interval.
[a]Percentage of sample.